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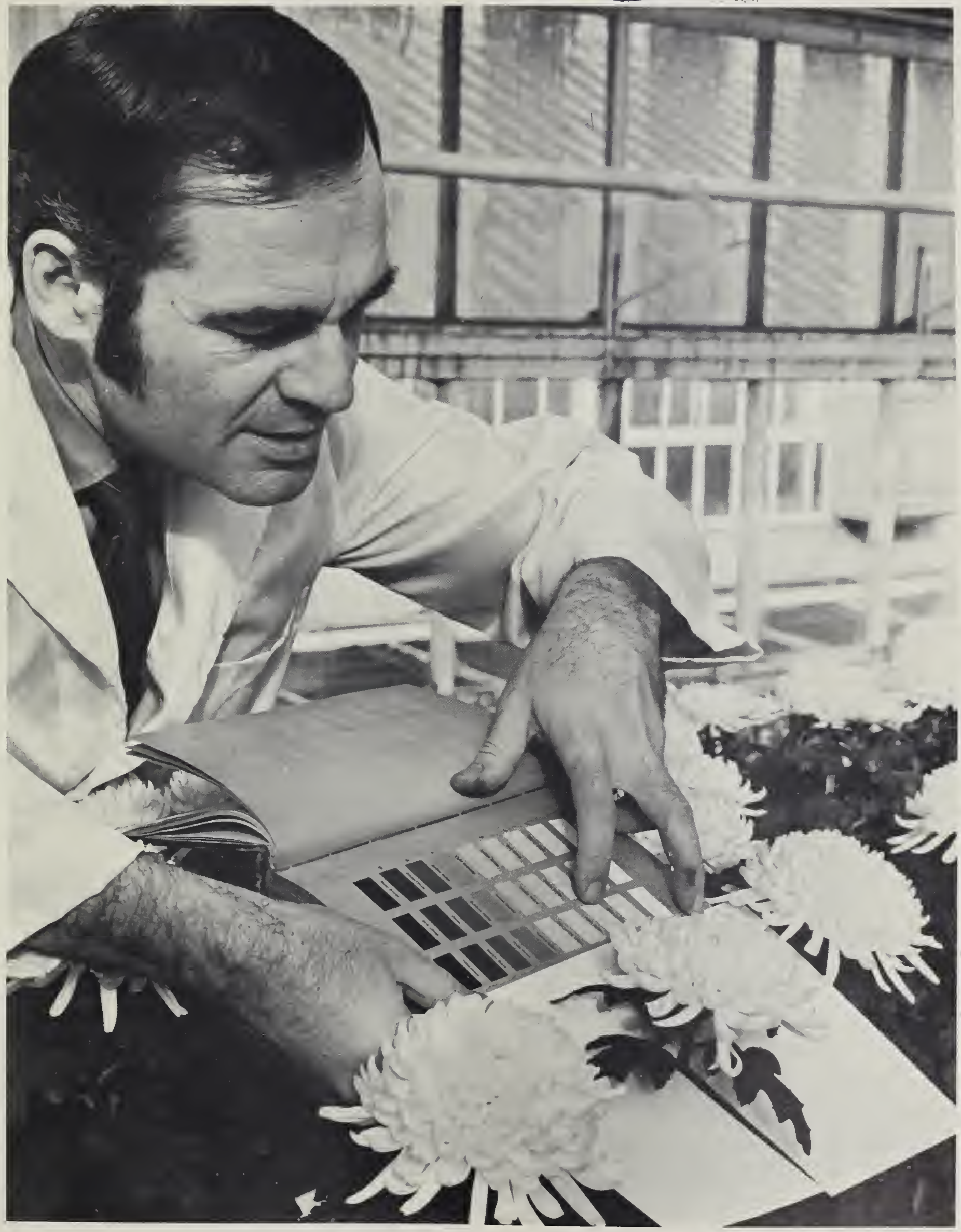

AGRICULTURAL
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The Golden Hoof

The shepherd and his flock stand silhouetted against the backdrop of history. From ancient times the trails of sheep have marked the world's tradeways, and the course of empires followed routes first etched by hooves. Indeed, sheep husbandry is linked more closely with civilization than any other industry.

Nurtured in the Near East, sheep spread across Europe. In England their valued fleeces supported an "Empire of Wool"—at its height under Henry VIII and Elizabeth I. Henry seized the flocks of monasteries and redistributed them among his favorites, who fenced them in. This threw shepherds out of work and set off a surge of migration to the new American colonies.

Although the British prohibited a colonial woolen industry, sheep smuggling prospered. The enraged British made sheep and wool trading an offense. The penalty: loss of the right hand. Along with the infamous Stamp Act, suppression of the sheep industry helped foment the Revolutionary War.

Early American farmers kept small flocks to supply wool for homespuns. Later, sheep accompanied the wagon trains headed westward. In time, the West Coast raised sheep of superb quality. Ironically, demond for them as foundation animals gave rise to the era of Great Trails—with traffic headed east. In its heyday, the three decades after the Civil War, unheralded flockmasters on the trail met raw nature and outlaws on the same terms as cowboys and prospectors. At about this time, lamb feeding joined range herding and farm flocks as sheep enterprises.

When agriculture mobilized for World War II, U.S. sheep numbers reached their record high of 56 million head. But numbers have slumped since, although lamb and mutton production fared better. Many problems contributed to the industry's decline including labor, predators, parasites, and high costs.

To help revitalize the industry, ARS scientists are engaged in a multifaceted research effort. One approach, for example, is to increase the ewe's annual lamb crop. Through selection, Morlam strain ewes are lambing at any season more often than once a year; in related research, hormones are inducing similar results. The present national lambing rate is 96 lambs per 100 ewes. ARS scientists are confident that 800 lambs is a possible ultimate goal.

In other research, artificial rearing shows that most of the lambs which starve before market age, about 20 percent of the crop, can be saved. Someday chemical shearing may trim labor costs. Repellents may stem the ravages of coyotes and dogs. And breeding and nutrition research may make lamb a better competitor at the meat counter. Agricultural science will foster the well-being of sheep, long a sharer of our human heritage.

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COVER: ARS horticulturist Henry M. Cathey compares chrysanthemums with color chart. Mums were treated with 6706, a chemical that can "bleach" flowers and leaves (pp. 8–11). Dr. Cathey is exploring ways to use 6706 to produce much desired white flowers as well as variegated foliage in ornamentals (0170A7-9).

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Packaged meals for insects

Aphid lion, ⅓-inch long, feeds on artificial eggs. Scientists rear the lions in individual compartments to prevent cannibalism (PN–1955).

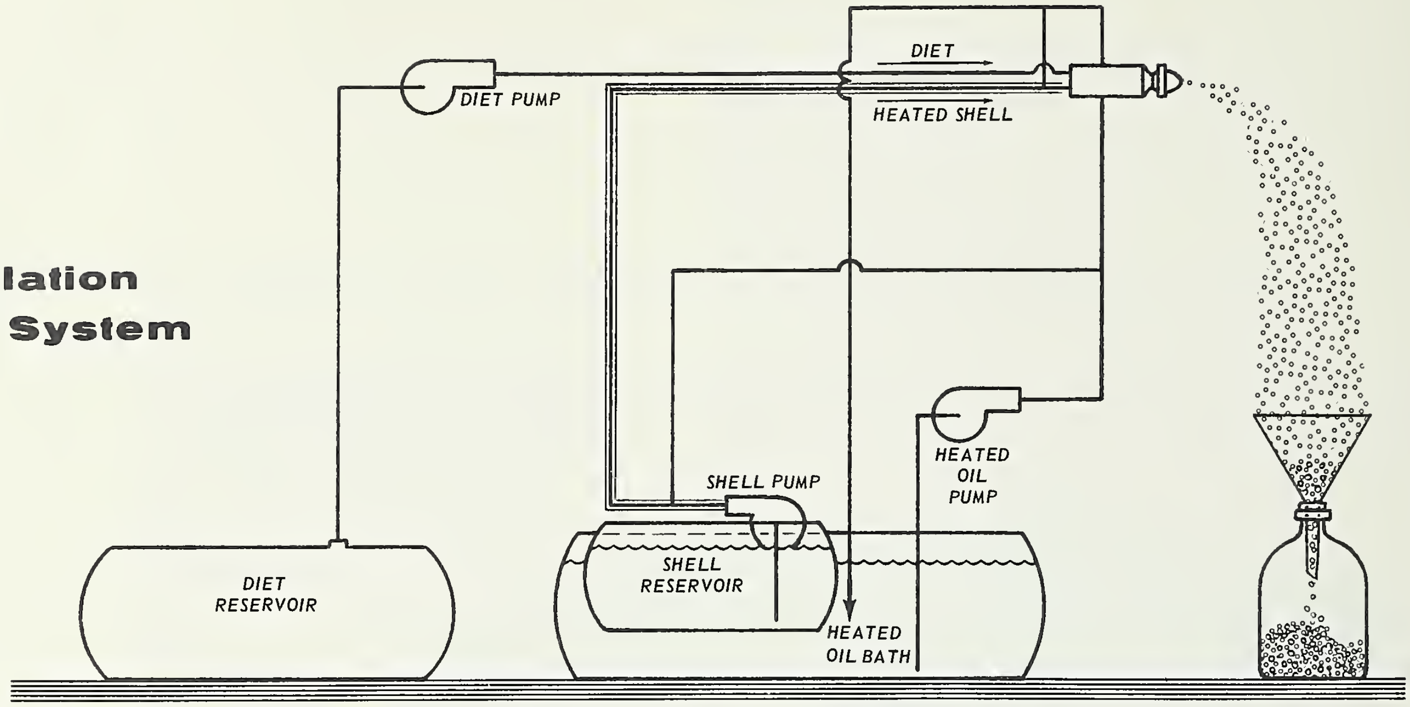
An artificial diet packaged in capsules simulates the insect eggs eaten by aphid lions, larvae of a beneficial insect called the green lacewing (*Chrysopa carnea*). These inexpensive artificial eggs enable scientists to rear large numbers of aphid lions for biological control experiments.

Aphid lions are under study because they are predators of bollworms and tobacco budworms on cotton and may prove an effective control when released in sufficient numbers at the right time.

Previously, scientists reared aphid lions on the eggs of Angoumois grain moths at a cost of up to $300 per pound of eggs. Later, ARS biochemist Erma S. Vanderzant developed an artificial diet which scientists recently succeeded in encapsulating. These artificial "eggs" can be produced for less than $5 per pound.

Experiments with the encapsulated diet were conducted by entomologist Richard L. Ridgway, technician Virgil S. House, and Dr. Vanderzant at the ARS entomology laboratory, College Station, Tex., in a cooperative program with Texas A&M University. The research was carried out in collaboration with chemist Clarke E. Scheutze, of the

Encapsulation System



Southwest Research Institute, San Antonio, Tex. Cotton Inc., Raleigh, N.C., partially financed the project.

After testing about 50 capsule materials, the scientists selected one consisting of paraffin wax, candellia wax, polyethylene, and polybutene. These constituents prevent loss of substantial amounts of the diet from the capsule, and have the necessary physical properties to permit the aphid lions to puncture the "eggs" and suck the juices.

Capsules are made with an experimental device that meters the diet material through the center of a modified pneumatic nozzle. Material used in the capsule shell is heated and metered through the outer part of the nozzle, thus forming a ring around the diet.

As the material leaves the nozzle, the capsule shell forms around the diet and hardens in a ball as it falls about 3 feet in chilled air to a bin in which the capsules are collected. About 1 pound of capsules is produced per hour by the laboratory model.

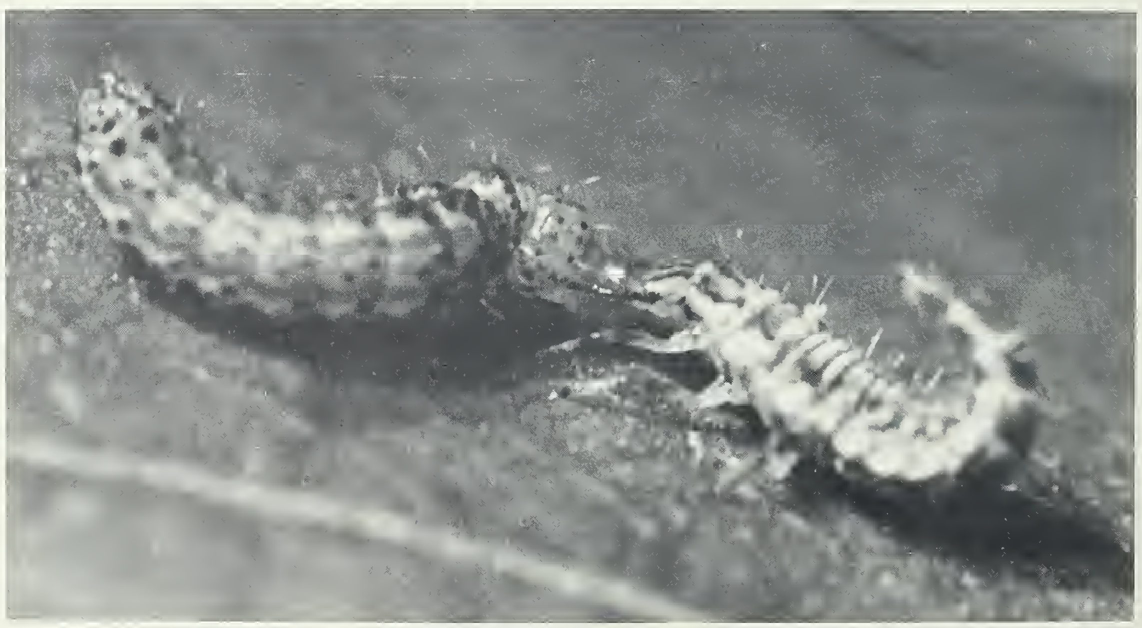
Twelve generations of aphid lions have been reared on the capsules. The weight and fertility of the insects indicate that they are of equal quality to those fed a natural diet, even though they took longer to reach adulthood when fed on the capsules.

The scientists obtained a 61-percent yield of adults from larvae reared on the capsules. This yield is only 12 percent less than that obtained with a moth egg diet, a difference that is insignificant in view of cost comparisons between the two diets. The scientists' results are also better than those in nature, where only a small fraction of the insects survive to adulthood because of natural enemies, diseases, adverse weather, and other factors.

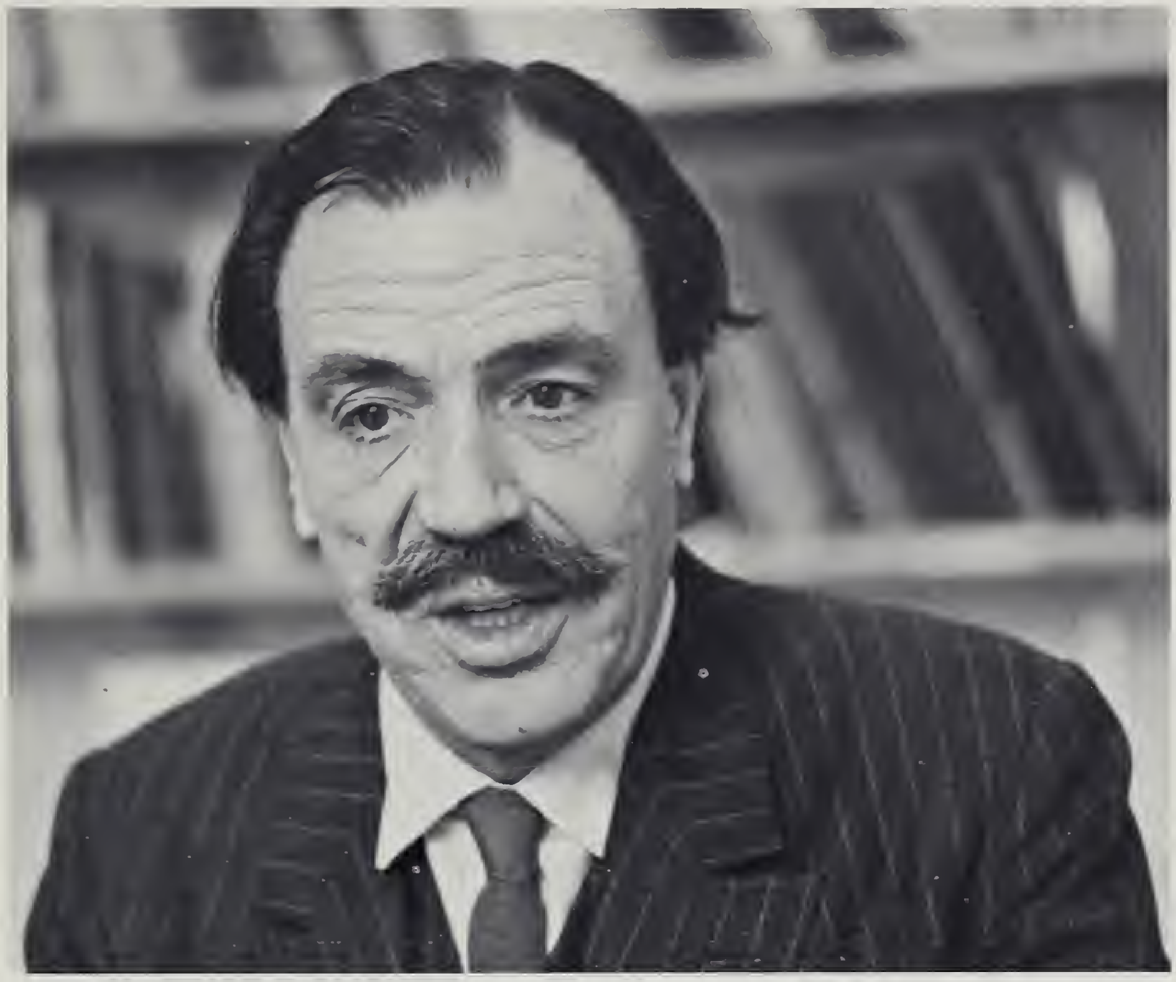
Aphid lions' resistance to certain insecticides and their habit of seeking out caterpillars on cotton favor their potential application in biological control of insect pests (AGR. RES., Dec. 1967, p. 10, and Nov. 1969, p. 16). Further experiments will be made under field conditions to evaluate practical uses of these beneficial insects. ■

Above: Pneumatic nozzle forms capsule by metering diet and shell materials through its inner and outer parts respectively. Capsule then drops to collector through chilled air. Carefully controlled temperatures are essential for satisfactory capsule formation. Outside diameter of capsule is 500 microns—five times the width of a human hair (PN–1956).

Right: An aphid lion attacks a bollworm by piercing the caterpillar with its fangs and sucking the body juices (PN–1957).



'MAN: PLANETARY DISEASE'



Professor McHarg (0171A62–17).

MAN is a planetary disease, declares Ian L. McHarg, pioneer landscape architect against environmental abuse. "Not only is man a planetary disease, but the disease itself is epidemic."

But this pathogenicity need not be irrevocable, added Prof. McHarg in presenting the fourth annual B. Y. Morrison Memorial Lecture. Instead of inflicting lesions upon the earth in a manner parasitizing every living thing, he said, man must reshape his values to incorporate reverential regard to the indispensable elements in the environment. Man must design with nature, not militate against it.

This year's Morrison Memorial Lecture was given in Portland, Oreg., at the North American Wildlife and Natural Resources Conference under the auspices of the Wildlife Management Institute. This lecture series is sponsored by ARS in honor of Benjamin Y. Morrison, first director of the National Arboretum.

The symbiotic relationship that should exist between man and his environment was the central theme of Prof. McHarg's lecture, "Man: Planetary disease." He cited as an example the oxygen-carbon dioxide cycle—the indispensable balance of exchange between plants and animals that is the basis of life. To achieve symbiosis, however, we must understand that man alone is not divine; that his dominion over the earth is not absolute; and that man, in his dependency on all living things, cannot subjugate the earth. For in thinking and attempting to do so, Prof. McHarg maintains, mankind has fouled the water, polluted the air, destroyed ecosystems and their biota and, in short, has put *Homo sapiens* on the high road to self-extinction.

The key to reversing this folly, he said, is the understanding of evolution as a creative process. "The hammering of protons into nuclei and the binding of electrons in shells around them: every step up the periodic table, every step in the file of genetic skill of plants, animals, of ecosystems—every step is creative, employing energy and matter" to achieve higher levels of order.

He emphasized that this thinking is contrary to man's traditional cultural patterns in which earth is looked upon as an inert backdrop to be exploited for the sole edification, convenience, and profit of the human social order.

Prof. McHarg called for the rejection of anthropomorphic and anthropocentric thinking. Man must instead become the steward of his environment, which the lecturer praised as a "miraculous arena . . . this improbable, magnificant earth."

Founder and chairman of the graduate Department of Landscape Architecture and Regional Planning at the University of Pennsylvania, Philadelphia, Prof. McHarg is a practicing landscape architect, regional planner, professor, lecturer, and writer. His publications include the book *Design with Nature*, which was one of the five finalists in the scientific category for the 1971 National Book Award. ■

UV light preserves maple sap

MICROBES, those persistent contaminants of maple sap, can now be controlled by agitating the sap under ultraviolet (UV) light.

Maple sap is extremely perishable. Although sap is sterile as it comes from the tree, the bacteria which soon invade it multiply rapidly during storage, giving the sirup made from the sap a poor color, an off-flavor, or a "ropy" texture. Previously, the only way to prevent this has been to boil the sap to sirup as quickly as possible after collection.

ARS microbiologist John C. Kissinger and chemist Charles O. Willits (now retired) knew that UV light was a good sanitizer but it penetrated only a short way into the sap when placed over the storage tanks. Bacteria were not effectively killed at depths greater than 3 feet. Agitating the sap overcame this problem. The tests were conducted at Bainbridge, N.Y., under a contract administered by ARS' Eastern marketing and nutrition research laboratory in Philadelphia, Pa.

Four 1,000-gallon galvanized iron tanks equipped with UV lights to illuminate the entire surface of the sap, were used in the experiment. The goal: Keep sap fresh for 5 days. Tank 1 contained raw sap with no treatment to inhibit bacterial growth. Tank 2 contained sap pasteurized by UV irradiation before storage. Tank 3 contained unpasteurized sap, but the tank was irradiated with UV light and the sap was agitated. In tank 4, the sap was pasteurized by UV irradiation before storage and stored under UV lights, but was not agitated. This procedure was followed for three maple sap seasons.

The sirup made from the untreated sap after storage in tank 1 was usually one grade darker than sirup from the UV-irradiated sap. And it had high bacterial counts accompanied by bad odor, off-flavors, and occasional ropy texture. Pasteurization of sap before storage in tank 2 reduced the bacteria temporarily, but without further irradiation, the numbers of bacteria increased during the 5-day storage period.

Bacteria in tanks 3 and 4 were effectively controlled with UV light in combination with agitation (tank 3) or pasteurization (tank 4). However, the high cost of equipment used for pasteurizing the sap by UV light before storage makes it impractical for the average maple producer.

Sirup made from the UV-irradiated sap after storage was comparable in quality to sirups made from commercial lots of the same fresh sap.

A big plus for irradiated sap is that UV light, unlike preservatives or other additives, leaves no residue and does not affect the quality of the final product. And the inexpensive addition of an agitator to the storage tank gives the sap a longer keeping time. ■

Chemist Ransom A. Bell, Jr., removes sample of maple sap from UV-irradiated tank for analysis of bacterial content (1170A1059–1).

***Above:** Two subjective ways to judge potato chip quality are comparing samples with color photos or with standard color papers (color: K492–4; b&w: PN–1946). **Below:** Color of chip samples is measured objectively with a color difference meter (color: K492–5; b&w: PN–1947). **Bottom:** Bean standards go under powerful lights to test effectiveness of treatment applied to prevent fading. Mr. Yeatman checks light intensity (color: K492–1; b&w: PN–1948).*

When color matters

THE HUMAN EYE sometimes tells us less about food products than we need to know—a limitation that specially designed instruments may surmount.

Intended ultimately for use at packinghouses, warehouses, or processing plants, such instruments would objectively measure differences in food color, texture, glossiness, and other visual properties that can be missed or distorted by the eye. And unlike the eye, they would operate untiringly, providing uniform evaluations day in, day out.

Instruments developed by ARS and commercial firms to detect ripeness of blueberries, apples, tomatoes, oranges, and other commodities were tested by food technologist John N. Yeatman at the ARS Color Research Laboratory, Beltsville, Md. The devices show potential for commercial application if they can be automated.

Other tests at the laboratory indicate that the color quality of lighting conditions in a room and the color of the walls influence the visual perception of a product. Under certain conditions, some products seem redder than they are, for example.

Color standards against which food products are compared are also under study. The color of beans used as standards will change after extended exposure to light. Mr. Yeatman is determining whether chemical treatments developed by USDA's Consumer and Marketing Service stabilize the color of the standards for various beans.

This laboratory's research is part of a continuing ARS effort to develop new or better ways to objectively measure food qualities that consumers demand.

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the telltale herbicide

BLEACHING of foliage color is a by-product of one of the two mechanisms by which an experimental herbicide inhibits plant growth. The mechanisms affect photosynthesis—one by interrupting the development of functional chloroplasts, which produce color pigment; the other by preventing preformed chloroplasts from photosynthesizing.

The new herbicide, 4-chloro-5-(dimethylamino)2 - (α,α,α, - Trifluro-*m* - tolyl)-3(2*H*)-pyridazinone, was developed commercially and is known under the code number 6706. It is closely related to the older herbicide, pyrazon, and is being tested for control of broadleaf and grassy weeds in field and horticultural crops. Unlike pyrazon, which causes growth inhibition, desiccation, and death of green foliage, 6706's initial symptom is the development of white foliage. This more closely resembles the action of other herbicides that prevent greening in plants.

Herbicide 6706 is being tested at Beltsville, Md., by plant physiologists James L. Hilton and Judith B. St. John, plant pathologist Albert L. Scharen, and agricultural engineer Karl H. Norris, and at Raleigh, N.C., by plant physiologist Donald E. Moreland.

The scientists found that 6706 acts directly by inhibiting a step in photosynthesis. While pyrazon and 6706 are equally phytotoxic in this reaction, 6706 has a longer effective period.

Moreover, 6706 interrupts the development of functional chloroplasts, preventing new plant foliage from developing the mechanism necessary to carry out photosynthesis. 6706 does this at a hundredth to a thousandth of the concentration of any other herbicide known to cause a similar effect. And since the chloroplasts produce the color pigments, new foliage is white or red depending on whether the plant can make the red anthocyanin pigments.

Apparently, the time of treatment governs which mechanism is chiefly involved in controlling plant growth. When 6706 is applied pre-emergence, the plants come up either white or red and continue growing as long as food reserves in the seeds hold out. Herbicidal action then results from the lack of functional chloroplasts. This action is reinforced by the direct inhibition of photosynthesis in any functional chloroplast that does develop.

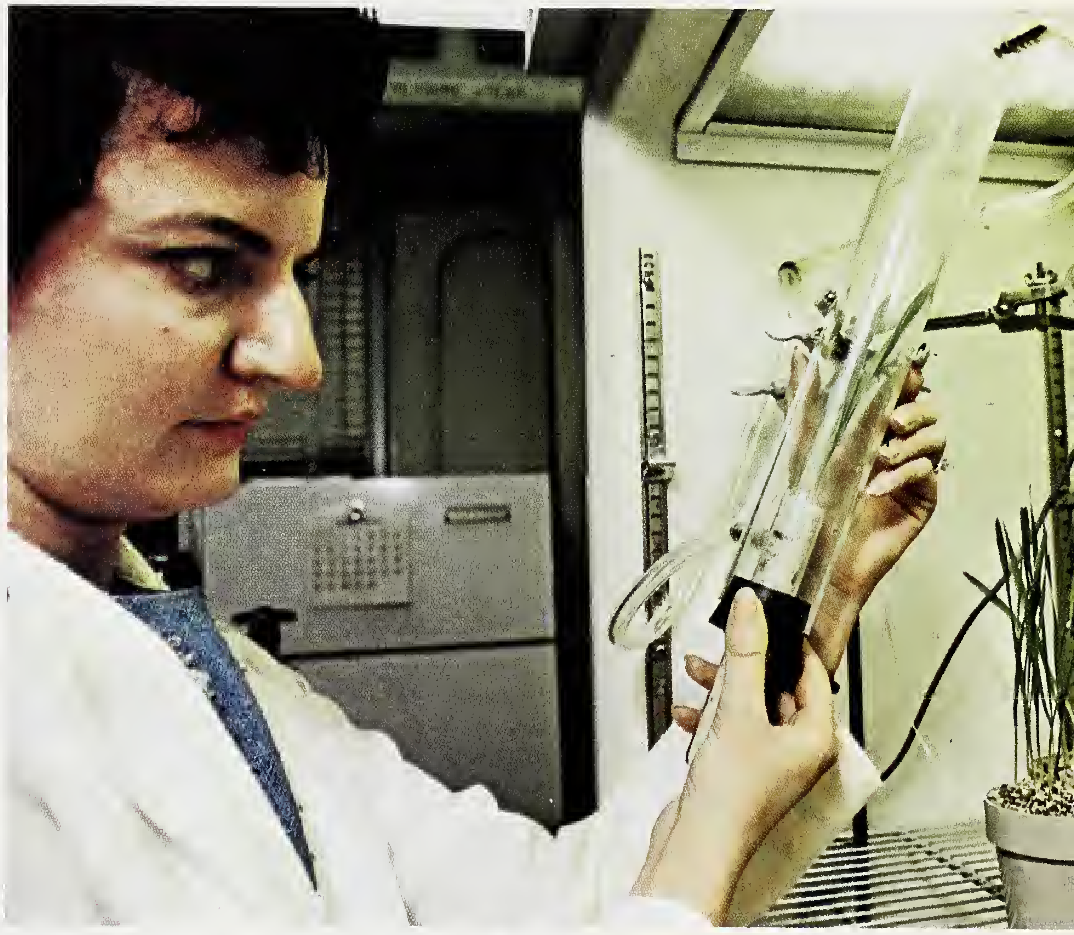
When the chemical is applied to established green plants, growth control results from the direct inhibition of photosynthesis in the functional chloroplasts already formed. And should new leaf tissue develop on the treated green plant, the herbicidal action is supplemented by failure of the new leaves to develop the functional chloroplasts.

Although most herbicides are believed to act by more than one mechanism, these studies show that 6706 clearly and convincingly demonstrates a double mechanism. Lethal action by either or both of the mechanisms can be circumvented by feeding common table sugar to treated plants. However, this doesn't prevent the plants from being white.

Interestingly, the bleaching effect of the chemical could act as a "tattletale" indicator of its presence in soils and

Dr. Hilton drops 6706 onto soil around barley in a growth chamber. Pre-emergence treatment proved better, however, because it killed younger plants more easily. The herbicide comes as a water-soluble powder for application as a liquid spray (color: K439–8; b&w: BN–37189).

Dr. St. John measures the effectiveness of 6706 with a photosynthesis tube. Treated plant is placed in tube containing a known amount of carbon dioxide (CO_2). Since 6706 inhibits CO_2 fixation, the more CO_2 remaining in the tube after the test period, the more effective the treatment (color: K439–2; b&w: BN–37192).



could help growers gage the proper time for planting subsequent or rotation crops. For example, the presence of any white-colored plants in a previously-treated field would show that active residues of 6706 remained.

Herbicide 6706 is an experimental compound and is not registered by USDA for any use. It is available only to qualified investigators for basic studies, and for evaluation of its potential for weed control in cotton and in other relatively tolerant crops.■

White foliage marks barley treated with 6706, which was applied before emergence. Treated plants grow until food reserves in the seed are used up (color: K439–17; b&w: BN–37191).

Dr. Cathey checks color variations of chrysanthemums with a standard reference chart. Lower mum is untreated. Mums need only one treatment; marigolds and poinsettias require several (color: K504–15; b&w: 170A7–14).

Whiter flowers on command

THE EXPERIMENTAL herbicide 6706 works in one way by "turning off" the color-making apparatus in plants, an effect that could "turn on" the growers and florists who want ornamentals with pure white blooms and foliage.

The chemical bleaches color from poinsettia bracts and from marigold and chrysanthemum blooms, turning them pure white.

White flowers have long been in demand for weddings, funerals, and for other ornamental purposes, but only a few species such as lily, gladiolus, and some chrysanthemum varieties meet this criterion. Even these are not entirely satisfactory. The gladiolas and lilies have green throats or centers; the mums often are not the best varieties for year-round flowering, and some cultural practices such as over-fertilizing tend to turn the mums off-color.

In previous research, ARS horticulturist Henry M. Cathey at Beltsville, Md., found that certain growth-regulating chemicals could affect plant coloring. But when concentrations were high enough to affect the color, they proved toxic and inevitably killed the plants. Since it had been reported that

6706 interfered with the development of chloroplasts, the mechanisms responsible for producing color pigments in plants, and that the chemical was effective at very low concentrations, Dr. Cathey wanted to know if it would prevent yellow and green pigments from developing in blooms without harming or affecting other plant parts.

When he applied 6706 to the soil of foliage plants, some tolerant species, including ivy, peperomia, and rubbertree, produced variegated green and white foliage. However, when 6706 was applied directly to the florets or bracts of other species, the flowers and bracts developed fully but without normal color. For example, Indianapolis chrysanthemum, which usually produces a whitish flower with a deep butter-colored center, came out pure white. Marigolds normally orange, mums ranging from cream to orange, and poinsettias usually cream-colored, all produced pure-white flowers or bracts after treatment. Other species with flowers of cream color or any shade of yellow turned white. But those with bronze color turned pink, maroon turned wine, and red turned orange.

The tests indicated that 6706 removes yellow and green chloroplasts and affects primarily the outer cell layer. Mums required only one treatment to maintain the white color; marigolds and poinsettias needed two or more treatments weekly during development.

"The treatment is simple," says Dr. Cathey. "As soon as I detect the beginning of color, I apply 6706, dissolved in water, directly to the florets or bracts and wet them completely. Essentially that's about all there is to it."

Besides growers and florists, breeders also could use this finding to screen seedlings for a single color pigment to aid in producing white-flowered plants.

In future studies, Dr. Cathey will seek systems that promote the formation of pigments in flowers. Once this is accomplished, chemicals that control the shape, size, growth, and color will permit grown-to-order ornamentals. ■

Peperomia, a popular houseplant, is normally all green but 6706 treatment has produced variegated foliage.. Chemically induced variegation does not harm the plant (color: K504–18; b&w: BN–37190).

Dr. Cathey sprays chrysanthemum bud with 6706. The treatment turns off chlorophyll synthesis in the bud before blooming (color: K504; b&w:BN–37188).

Microbiologist Virginia C. Wommack spreads raw milk on the specially designed slides (171A96-12).

Screening milk for signs of mastitis

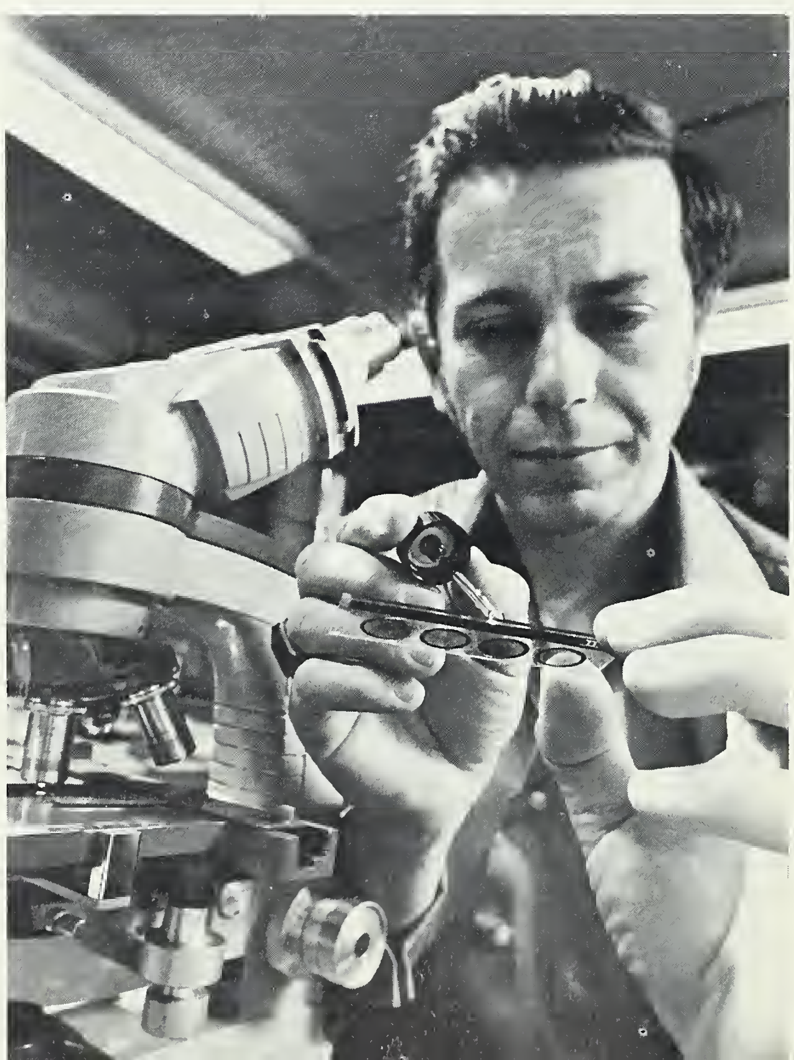
MORE ACCURATE SCREENING of milk for abnormalities related to mastitis is now possible—assuring dairymen that milk won't be held off the market because of testing error.

Mastitis, inflammation of a cow's mammary gland, costs U.S. dairy farmers $500 million annually in lost income, since it causes milk production to drop off and milk that is produced may not be marketable, explains ARS dairy scientist W. Donald Schultze.

In the present quality control process, milk first goes through one of several screening tests to classify it as acceptable or doubtful. All the doubtful samples must then be further tested to determine their acceptability.

Results within and between the screening tests, however, may be inconsistent, causing a wide range of error. Thus, many acceptable milks are subjected to a confirmatory test—a waste of time and money.

To permit viewing of cells under the microscope, Dr. Schultze stains the milk (171A96-23).



...more accurate test

The screening test developed by Dr. Schultze is a shortened version of a generally accepted confirmatory test—Direct Microscopic Somatic Cell Counting, DMSCC (AGR. RES., Mar. 1969, p. 11). This new method permits the rapid classification of most milk samples as either acceptable or unacceptable. Only those few that fall within a narrowed range of cell counts require the use of the confirmatory test.

Testing methods are directly or indirectly based on the fact that when

Dr. Schultze checks strip chart on the OSCC potentiometric recorder to determine the cell count of the sample (171A96–25).

the mammary gland is inflamed, white cells are transferred to the milk from the blood in larger numbers.

White cells themselves are not harmful, but in large numbers they indicate udder inflammation and changes in the milk that make it unsuitable for use. The control cell limit is 1.5 million per milliliter of milk.

The DMSCC works this way: Milk samples are drawn from bulk milk tanks. A 0.01 ml. drop is placed on a slide, spread thin, dried, and stained; then the cells on the slides are counted. But thickness of the spread and thus, the concentration of cells, vary from area to area on the slide.

To overcome this problem, Dr. Schultze and his colleagues designed a special slide with premarked circles on it, 1 square centimeter in area. And to define even more precisely the area for counting, he designed a special reticle, a thin glass disk that fits in the microscope eyepiece, with parallel lines etched into it.

A pair of lines, or "strip," is designed so that about 100 cells in a strip can represent the critical cell count—1.5 million per ml. Since thickness of samples varies even within the square centimeter circle, the more strips that are counted, the greater the confidence in the results. Two strips on each of two replicate milk films are counted when DMSCC is used for confirmation; a single strip in the screen test.

Both single- and four-strip versions of DMSCC require identical preparation, so all the technician must do with a questionable screening test sample is to count three more strips.

The one-strip DMSCC method is now being considered for status as an official mastitis screening test for use in the United States.

. . .on to automation

IN FURTHER STUDIES of mastitis testing techniques, Dr. Schultze evaluated an automatic cell-counting system that would eliminate the need for individually counting cells through a microscope.

The automatic system, developed commercially, is called the Optical Somatic Cell Counter (OSCC).

Dr. Schultze found that the OSCC can handle up to 60 samples an hour for a practical average of 400 in an 8-hour day. This is 16 times faster than the DMSCC as a confirmatory test, which averages 25 per day.

The results from DMSCC and OSCC methods are very close. And unlike the microscope method, counting with OSCC permits one test to serve as a screen and confirmatory test. The tests are as reliable as the four-strip DMSCC.

The OSCC consists of five modules which all fit on the top of a 6-foot table: automatic sampler, proportioning pump, heated incubating bath, optical cell counter, and potentiometric recorder with strip chart display.

Milk is poured into 40 individual sample cups that are placed on a round, rotating tray. As sample cups rotate into position, small stirring rods that work like little egg beaters come down into the cups.

Then, a small portion is siphoned off, mixed with various reagents, and finally sent to the optical cell counter which includes a light source and a photoelectric cell. This sample flows through the path of light between the source and cell. If the liquid is clear, light passes through it and is blocked by a dark disk. If there are particles such as white cells in the liquid, light is deflected around the disk and into the photo cell. This creates electrical impulses which are picked up both on an oscilloscope screen for visual checking and on a continuous strip chart that records relative concentration of cells. ■

All versions of the DMSCC test were developed as part of an overall program of the National Mastitis Council, of which Dr. Schultze is a member. This independent organization counts in its membership people from many backgrounds and geographic areas who are interested in uniform regulation and efforts for abatement of mastitis.

Early tomato transplants escape wilt

THE LATER the dates for harvesting and transplanting, the higher the incidence of bacterial wilt disease in tomato plants grown in the South and transplanted to northern producing areas.

Southern bacterial wilt is one of the most destructive diseases of tomato plants grown in the Southern States. And despite use of the best sanitary procedures currently available, there is disease spread and loss in northern fields after shipping and transplanting.

To help reduce the loss, studies were conducted by ARS plant pathologist Thomas H. Barksdale, Beltsville, Md., ARS soil scientist Casimir A. Jaworski, Tifton, Ga., and plant pathologist States M. McCarter, Georgia Agricultural Experiment Stations, Athens.

Test plants were grown in infested and noninfested fields near Tifton, Ga., each spring from 1968 to 1970. After harvesting, they were shipped to Beltsville for transplanting. Different harvest dates were used representing early-, middle-, and late-season harvest. Only healthy-appearing plants were harvested. Some were removed from the soil with a shovel to simulate machine harvesting while others were pulled by hand. Once transplanted at Beltsville, plants were regularly checked for wilting symptoms from May to August.

The amount of bacterial wilt increased significantly the later the harvest and transplant—from 3.7 percent wilt for early harvest, to 9.6 percent for mid-season, to 25.6 for late. These are averaged percentages for the 3-year period and include all types of plant treatment, soils, and harvest. ■

No-Till for the Southeast

THE PROSPECT of getting two crops a year while practicing erosion control is prodding farmers, conservationists, and researchers in the Southeast to take a look at no-till planting.

No-till means planting a row crop without prior tillage. One example is the planting of grain sorghum or soybeans in the stubble of a harvested wheatfield. The only time the field is bare and susceptible to wind and rain erosion is during the fall when rains are light and the field is being prepared for winter wheat.

The second crop is a bonus possible because less time and labor are required; thus, the second crop can be planted and harvested before work for a new season begins.

ARS soil scientists Joseph O. Sanford and Donald L. Myhre and agricultural engineer James B. Allen of the Mississippi Agricultural Experiment Station, State College, conducted the study. On no-till plots, the scientists harvested 5.25 tons per acre (oven dry) of wheat silage—40 to 45 bushels as grain. Then they planted sorghum and soybeans.

The researchers favor sorghum as the second crop. Soybeans take longer to mature, leaving little time between the end of the soybean harvest and the beginning of preparations for planting winter wheat.

Crops on conventionally tilled (plow-disk-plant) plots, however, did emerge sooner, grow faster, and produce higher yields than those on no-till plots. Yields of soybeans were 34 and 26 bushels per acre for till and no-till methods, respectively. Corresponding values for grain sorghum were 69 and 63.

The study continues to compare labor and equipment savings on the no-till plots against the difference in yields between the till and no-till methods. Factors responsible for yield differences will also be investigated. ■

AGRISEARCH NOTES

Wasp parasites successful in Brazil

Biological control of a serious pasture pest, the Rhodesgrass scale, may become an international success story.

The scale looks like an abnormal, waxy growth at the base of grass plants. Heavily infested pastures dry up and must be replanted with grasses more tolerant to the scale. These substitute grasses, however, are often less desirable than Rhodesgrass.

To solve this problem, ARS entomologists imported two species of tiny wasp parasites of the scale from India (*Neodusmetia sangwani*) and Hawaii (*Anagyrus antoninae*) and distributed them to scientists in Florida and Texas. By mass-rearing the wasps and spreading them in these two States, the scientists greatly diminished the Rhodesgrass scale (AGR. RES., July 1967, p. 3). Like similar parasites, the wasps are harmless to man.

ARS and the Texas Agricultural Experiment Station, College Station, cooperated with the Agency for International Development in providing 750 wasps of one species (*N. sangwani*) to Brazilian entomologists, who released the insects' progeny in infested areas. After 3 years, "good" or "excellent" control of the scale was reported in 10 of 12 areas surveyed in northeast Brazil. The second species (*A. antoninae*) has been obtained from Florida for release in southeast Brazil, where the humidity was unfavorable for the first species.

Biological control is usually a long-term project, but the encouraging results in northeast Brazil may mean that control could be achieved there in the next 5 years.

Signs of scale infestation include clusters of small (1/8 inch), white, waxy globes at the base of grass plants. The pests spend most of their lives inside the globes sucking plant juices. In the U.S., the scale was first found in Texas in 1940. It then spread to other Gulf States (PN–1501).

Corn populations and row widths

In the South, the number of corn plants per acre may significantly affect yields during favorable seasons.

But at the highest yielding plant population, narrow 20-inch row spacing probably does not.

Preliminary research results suggest that Southern farmers should not exceed 20,000 to 24,000 plants per acre unless supplemental irrigation is available. Researchers also note that at the highest yielding plant population, the slight yield increase with 20-inch rows would not justify the investment in narrow-row equipment.

Agronomist Gene E. Scott of ARS and agronomist Lloyd R. Nelson of the Mississippi Agricultural Experiment Station, State College, studied five plant populations for 2 years. The populations ranged from 12,000 to 36,000 plants per acre each in both 20- and 40-inch rows.

In 1968, a favorable season, the best yield was about 100 bushels per acre with 24,000 plants per acre. At this plant population, the difference between the 40-inch and the 20-inch row spacing was negligible—0.8 bu/a.

In 1969, lack of moisture limited all yields to about 50 bu/a.

Quick-cooked soybeans

A new method of cooking soybeans, called radiofrequency dielectric heating, is a quick, effective way to improve their nutritional value.

Soybeans contain a substance that, if not inactivated by cooking, inhibits the livestock enzymes trypsin and erepsin and reduces the animal's ability to use soybean protein. A 30- to 50-percent increase in nutritive value has been observed after proper cooking.

Agricultural engineers Stuart O. Nelson and La Verne E. Stetson, both of ARS, and biochemist Raymond L. Borchers of the Nebraska Agricultural Experiment Station, Lincoln, investigated a method in which dry whole beans are subjected to radiofrequency dielectric heating for approximately 1 minute. The method raises the beans to a temperature of 280° F. Dielectric heating is similar to microwave heat-

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ing except that it employs electric fields of lower frequency and higher intensity than those used in modern microwave ovens.

The usual laboratory method of cooking soybeans, termed roasting, is in a steam pressure cooker at 250° F. for 20 to 30 minutes or in a pot of boiling water for 1 hour.

A bonus from herbicides

At the same time that some herbicides control weeds, they also reduce pathogenic soil fungus populations—an unexpected bonus at no extra cost.

In greenhouse experiments at Beltsville, Md., ARS soil microbiologist Donald D. Kaufman has found four herbicides thus far that produce statistically significant effects on the number and kind of fungus populations. These effects are influenced by the rate of application, the crop, and the chemical used.

Dr. Kaufman applied diuron and linuron to corn- and to soybean-cropped soil and atrazine and simazine to fallow and to corn-cropped soil. Herbicides were applied at recommended rates.

Diuron and linuron had no effect on fusaria (root-rotting organisms) in corn soil, but they did decrease the number of fusaria in the soybean soil. The number of fusaria in atrazine-treated soils were significantly lower than in soil treated with simazine.

In future research, the experiments will be extended to include numerous other chemical compounds and an array of other crops. Linuron is registered for use on soybeans and corn; atrazine and simazine are registered for use on corn; diuron is registered only for field corn.

New sterilants for male insects

A new group of chemicals that effectively sterilize male insects has been developed at Beltsville, Md.

Previously, males have been sterilized only by radiation and three well-defined groups of chemosterilants: Alkylating agents, phosphoramides, and *s*-triazines. Males do not respond to many compounds effective on female insects.

The fourth group of male sterilants—substituted dithiobiurets—were recently produced in laboratory studies by ARS chemists James E. Oliver, Shen C. Chang, Alexej B. Borkovec, and Richard T. Brown. Of 22 dithiobiuret compounds, 12 proved active on male houseflies when injected at 5- or 10-microgram concentrations. The tested compounds are being studied further to evaluate their potential.

Cool birds gain better

Broilers raised in summer under a moderate, constant temperature outgained birds left to normal temperature fluctuations.

ARS poultry scientists at the South Central Poultry Research Laboratory, State College, Miss., compared body weight and feed use of broilers raised in controlled environment and in conventional houses. Tests were run during the summer when the temperature cycle during a 24-hour period was 75° to 95° to 75° F.

All birds were raised the same way from 1 day to 4 weeks, then separated into treatment or control groups from 4 to 8 weeks. Broilers in the controlled atmosphere treatments were maintained at either a constant 75° or 85°; control birds experienced the outside temperature cycle.

At the end of 8 weeks, birds held at 75° had an average body weight edge over controls of 0.37 pound for males and 0.25 pound for females. There was no advantage in the 85° treatment when compared to the control group.

The 75°-treatment birds also ate less feed per unit of body weight than controls, but this advantage disappeared after 6 weeks.

ARS poultry scientists James W. Deaton, Berry D. Lott, Leon F. Kubena, and James D. May, and agricultural engineer Floyd N. Reece conducted the research.

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